Universitat Autònoma de Barcelona

2020/2021

Hospital Physics

Code: 106071
ECTS Credits: 6

Degree	Type	Year	Semester
2500097 Physics	OT	4	2

The proposed teaching and assessment methodology that appear in the guide may be subject to changes as a result of the restrictions to face-to-face class attendance imposed by the health authorities.

Contact

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Use of Languages

Principal working language: catalan (cat)
Some groups entirely in English: No
Some groups entirely in Catalan: No
Some groups entirely in Spanish: No

Other comments on languages

Teaching indifferently Catalan / Spanish

External teachers

Ernest Luguera

Immaculada Martínez

Prerequisites

It is very convenient to have studies previously the subject of Radiation Physics in order to know the physical principles of the interaction of radiation with matter and the principles of operation of radiation detectors.

Objectives and Contextualisation

Medical physics is concerned with providing the scientific basis for the use of diagnostic and therapy technologies (conventional, computerized and digital radiology, magnetic resonance imaging, tomography, radiotherapy, particle accelerators, etc.), establishing criteria for the correct use of the physical agents used (ionizing radiation, microwaves, lasers, etc.), to set criteria for the radiological protection of workers and patients, to participate in the design of auxiliary instrumentation and establish standards for the measurement of many biological variables. Physicists perform specific healthcare tasks in hospitals, such as planning treatments with ionizing radiation, controlling radiology equipment, designing and controlling radiological facilities, or controlling staff and areas exposed to radiation. .

The figure of the physicist working in hospitals performing this type of task is legislated since the program for access to resident internal physicist was created. Through this program, the physicist develops a training period of 3 years in a hospital, through which the specialty of Hospital Radiophysicist is obtained, which entitles him to the professional development of the aforementioned tasks.

Thus, the main objective of the subject is to prepare students to be able to successfully access the Resident Internal Physicist program and train them for the professional career of Hospital Radiophysicist. These objectives are specified in:

- To study the concepts of metrology and dosimetry of ionizing radiation
- To know the physical principles of diagnostic imaging
- To study the physical principles and practical applications of nuclear medicine
- To know the physical principles on which radiation therapy is based
- To study the principles of radiological protection, as well as the magnitudes and units used in the radiological protection system
- To apply the concepts learned in a real hospital physics department

Competences

- Act with ethical responsibility and respect for fundamental rights and duties, diversity and democratic values.
- Apply fundamental principles to the qualitative and quantitative study of various specific areas in physics
- Be familiar with the bases of certain advanced topics, including current developments on the parameters of physics that one could subsequently develop more fully
- Carry out academic work independently using bibliography (especially in English), databases and through collaboration with other professionals
- Communicate complex information in an effective, clear and concise manner, either orally, in writing or through ICTs, and before both specialist and general publics
- Formulate and address physical problems identifying the most relevant principles and using approximations, if necessary, to reach a solution that must be presented, specifying assumptions and approximations
- Make changes to methods and processes in the area of knowledge in order to provide innovative responses to society's needs and demands.
- Plan and perform, using appropriate methods, study, research or experimental measure and interpret and present the results.
- Take account of social, economic and environmental impacts when operating within one's own area of knowledge.
- Use critical reasoning, show analytical skills, correctly use technical language and develop logical arguments
- Using appropriate methods, plan and carry out a study or theoretical research and interpret and present the results
- Work independently, have personal initiative and self-organisational skills in achieving results, in planning and in executing a project
- Working in groups, assume shared responsibilities and interact professionally and constructively with others, showing absolute respect for their rights.

Learning Outcomes

1. Carry out a hospital visit, visit the main medical services with radiation-emitting equipment and carry out some kind of test to understand the way they work.
2. Communicate complex information in an effective, clear and concise manner, either orally, in writing or through ICTs, in front of both specialist and general publics.
3. Explain the explicit or implicit code of practice of one's own area of knowledge.
4. From the point of view of radiological protection, characterise a radioactive installation with medical applications (radio diagnostic, nuclear medicine, radiotherapy, etc.).
5. Identify situations in which a change or improvement is needed.
6. Identify the social, economic and environmental implications of academic and professional activities within ones own area of knowledge.
7. Plan radiation or exposure for the elimination or characterisation of different types of tumour.
8. Understand the bases of conventional therapy using radiation.

9. Understand the different types of accelerators, radiation-emitting equipment and radioactive sources for medical applications.
10. Understand the effects of ionizing radiation on living beings.
11. Understand the physical principles of diagnostic imaging techniques.
12. Understand the physical principles of nuclear medicine.
13. Use critical reasoning, show analytical skills, correctly use technical language and develop logical arguments
14. Work independently, take initiative itself, be able to organize to achieve results and to plan and execute a project.
15. Working in groups, assume shared responsibilities and interact professionally and constructively with others, showing absolute respect for their rights.
16. Carry out academic work independently using bibliography (especially in English), databases and through collaboration with other professionals

Content

• Metrology and dosimetry of radiation
• Fundamentals of radiobiology
• Diagnostic Imaging
• Nuclear medicine
• Radiation therapy
• Radiological protection

Methodology

The subject has presential classes in theory, problems, laboratory practices and field trips. It is highly recommended to attend theory and problem classes, and it is mandatory to attend and perform laboratory practices and attend field trips.

During the course, the realization of directed activities will be considered, both of a more theoretical nature (bibliographic research and realization of works) and of a practical nature (problem solving and research of experimental data).

The student will have to dedicate an important part of the time in the extension of the knowledge given in class and in the personal study.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Laboratory demonstrations	6	0.24	4, 2, 3, 6, 5, 7, 13, 15
Problems solving at the classroom	10	0.4	4, 2, 3, 6, 5, 7, 13, 14
Theory lectures	27	1.08	4, 9, 10, 12, 11, 8, 3, 6, 5
Type: Supervised			
Filed visits: visiting real premises related to Hospital Physics	6	0.24	4, 9, 10, 12, 11, 8, 3, 16, 1, 6, 7, 13, 14, 15
Type: Autonomous			
Bibliographic tasks and problems	15	0.6	4, 2, 9, 10, 12, 11, 8, 16, 13, 14, 15

Preparing the practical reports and the field visit report	16	0.64	4, 9, 16, 1, 6, 5, 7, 13, 14, 15
Search for information and studying	61	2.44	9, 10, 12, 11, 8, 16, 6, 5, 14, 15

Assessment

The evaluation of the subject will be carried out with four types of activities:

1.- Theoretical and practical exams: There will be two partial exams with questions and problems on the syllabus taught in class or that the student has worked throughout the course that have an overall weight of 50%. Partial exams are held on the dates set aside for this activity in the physics degree calendar. Each midterm exam weighs between 20% and 30% over the final grade. The replay test, on the date scheduled in the physics degree calendar, allows students who have not passed one or both partials to have a second chance to do so. It is not foreseen that students who have passed the course will take the resit test to raise the grade.

2.- Tests of control and continuous evaluation that will realize during the course. By its nature, replay is not possible. Typically 3 tests are performed throughout the course. The overall weight of this activity is 20%. They can be done virtually through Virtual Campus.

3.- Evaluation of the laboratory demonstrations and of the field task. Based on the corresponding reports and the evaluation carried out by the teachers during the demostrations and field visit. The realization of the practices is an indispensable requirement to surpass the asignatura. The weight of this activity is 20%.

4.- Evaluation of the works and directed problems. With an overall weight on the note of 10%.

In order to pass the course it is mandatory to have a note of all the evaluable activities.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Control tests during the course	20%	1	0.04	9, 10, 12, 11, 8
Evaluation of demonstrations and field visits	20%	0	0	4, 2, 9, 3, 16, 1, 6, 5, 7, 13, 14, 15
Evaluation of supervised tasks and problems	10%	0	0	4, 2, 16, 5, 7, 13, 14, 15
Repesca: recovery of the two partial exams	50%	3	0.12	2, 9, 10, 12, 11, 8, 3, 6, 5, 13
Two partial exams. Each having a weight between 20 and 30%	50%	5	0.2	2, 9, 10, 12, 11, 8, 3, 6, 5, 13

Bibliography

J.T. Bushberg, J.A. Seibert, E.M. Leidholdt Jr., J.M. Boone. *The Essential Physics of Medical Imaging* (3rd edition). Wolters Kluwer. Lippincott Williams & Wilkins, 2012. ISBN: 978-0-7817-8057-5

H. Cember, T.E. Johnson. Introduction to Health Physics (4th edition). Mc. Graw Hill Medical. 2009. ISBN: 978-0-07-164323-8

F.M. Khan. *The Physics of Radiation Therapy.* Lippincott Williams & Wilkins, 2003. ISBN: 0-78 17-3065-1

E. Podgorsak. *Radiation Oncology Physics: A Handbook for Teachers and Students*. International Atomic Energy Agency (IAEA), Vienna, 2005. ISBN: 92-0-107304-6. Accesible throug the IAEA webpage: https://www-pub.iaea.org/mtcd/publications/pdf/pub1196_web.pdf